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SWASH PLATE COMPRESSOR FOR USE IN AIR CONDITIONING SYSTEM FOR VEHICLES

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FIG. 1

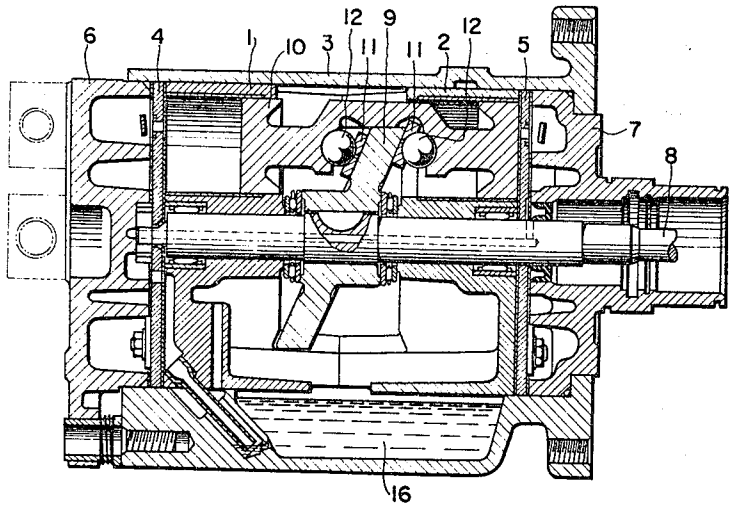
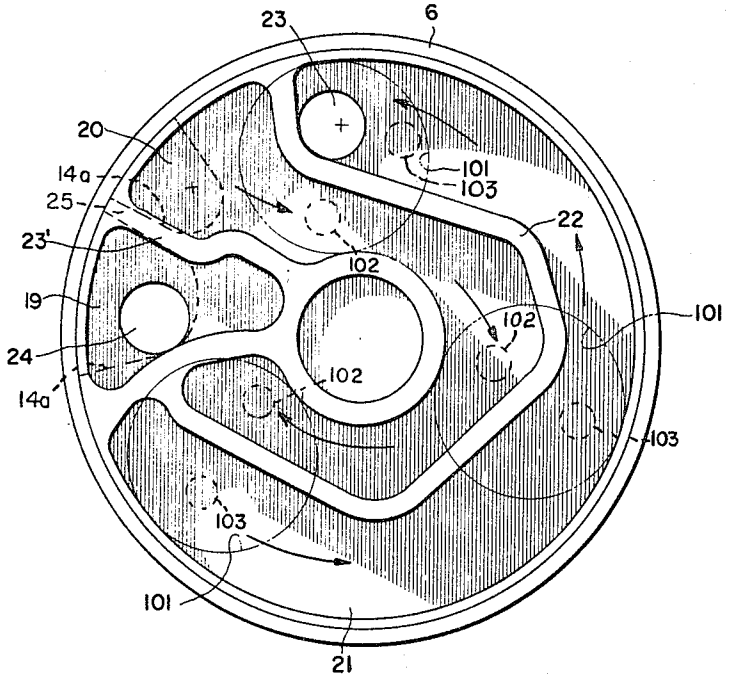


FIG. 3



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FIG. 2

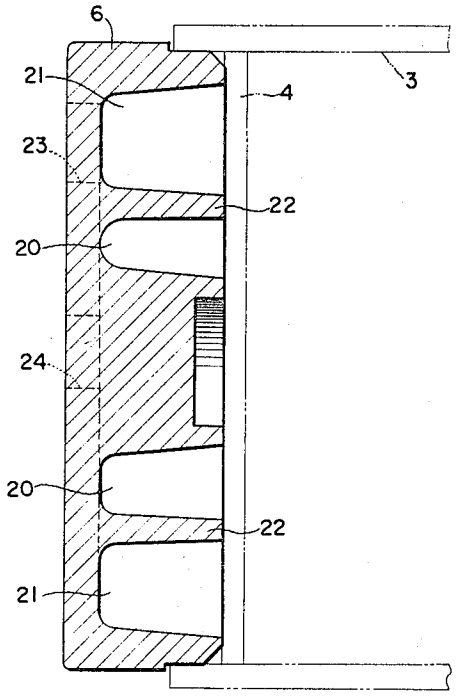


FIG. 4

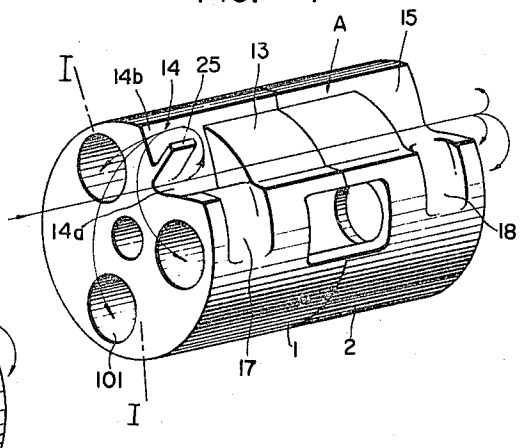
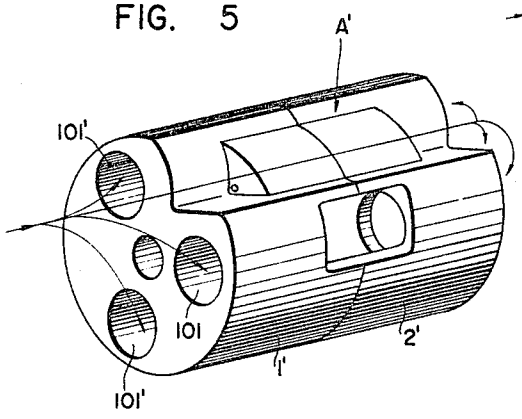


FIG. 5



United States Patent Office 3,380,651 Patented Apr. 30, 1968

3,380,651

SWASH PLATE COMPRESSOR FOR USE IN AIR CONDITIONING SYSTEM FOR VEHICLES

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Filed May 27, 1966, Ser. No. 553,371
2 Claims. (Cl. 230—178)

ABSTRACT OF THE DISCLOSURE

A swash plate type of compressor for use in an air conditioning system for vehicles, comprising a composite cylinder block having cylinder bores therein, which cylinder block is provided with a longitudinal oil separating channel in communication with the both ends of the cylinder bores, and a rear cylinder head housing which is provided with a refrigerant, inlet ports and inlet channels in communication with the rear end of said longitudinal channel, the rear cylinder head having a channel for conducting refrigerant from said oil separating channel to said cylinder bores.

This invention relates to a swash plate type compressor for use in an air conditioning system for vehicles and the like.

An object of this invention is to provide a swash plate compressor for handling the gaseous refrigerant (such as CF_2Cl_2) coming from an evaporator of the air conditioning system, wherein any lubricant oil mixed with the gaseous refrigerant may be effectively separated, thereby maintaining good refrigeration efficiency of the air conditioning system. Further objects and advantages of the present invention will be apparent from the following description and the accompanying drawings.

Of the drawings,

FIGURE 1 is a longitudinal sectional view of the compressor constructed according to this invention;

FIGURE 2 is a sectional view, on an enlarged scale, of a rear cylinder head housing;

FIGURE 3 is an end view thereof,

FIGURE 4 is a perspective view of the composite cylinder block employed in the compressor according to this invention; and

FIGURE 5 is a similar view of a conventional cylinder block employed in this type of compressor.

Referring to FIG. 1, in which an embodiment of the present invention is shown, the reference numerals **1** and **2** denote a pair of cylindrical blocks each having three cylinder bores, the rear cylinder block **1** and the front cylinder block **2**, being connected in series, as shown in FIG. 4, and enclosed in an outer cylindrical casing **3**. It is to be understood that the section of the composite cylinder block **1–2** in FIGURE 1 is taken along line I—I of FIGURE 4 for the sake of convenience. **4** and **5** are valve plates, and **6** and **7** are cylinder head housings mounted at the ends of the pair of cylinder blocks **1** and **2**, respectively. A drive shaft **8** is directly connected to the driving part of a vehicle engine. This drive shaft **8** carries a swash plate **9** securely mounted thereto. Both surfaces of the swash plate engage with pistons **10** through the intermediary of shoes **11** and a series of ball bearings **12**.

In FIG. 5 there is shown an example of a composite cylinder block having three cylinder bores, with the casing and end plates omitted heretofore employed in the swash plate compressor of the same general type as that of the present invention. The cylinder block shown in FIG. 5 consists of the rear cylinder block **1'** and the front cylinder block **2'** connected in series, each block having three cylinder bores, into which the gaseous

refrigerant returning from the evaporator is introduced directly or indirectly. The composite cylinder block **1'–2'** is provided with a suction channel A', and the gaseous refrigerant coming from an inlet port (not shown) in the casing (not shown) is introduced into the cylinder bores of the front cylinder block **2'** through said suction channel A', so that the oil content is separated while passing through said suction channel. On the other hand, a part of the refrigerant gas is directly introduced into the cylinder bores **101'** of the rear cylinder block **1'**, so that good oil separation cannot be expected. Consequently, the refrigerant gas delivered from the compressor unavoidably contains much lubricant oil, causing considerable drop of the refrigeration efficiency. The present invention aims to overcome such disadvantage by improving the arrangement of the said suction channel of the cylinder block and the rear cylinder head housing, as described below.

As shown in FIGS. 1 and 4, according to this invention the composite cylinder block **1–2** has a longitudinally disposed suction channel or oil separating channel A which includes a channel **13** and deep depressions or chambers **14** and **15** on the opposite ends thereof, said suction channel being enclosed by the cylindrical casing **3**, the rear valve plate **4** and the front valve plate **5** (FIG. 1). Said chambers **14** and **15** are in communication with an oil sump **16** through partially circumferential passages **17** and **18**, respectively. It must be understood that when the compressor is in the normal position, the channel **13** and chambers **14** and **15** are on the side of the compressor, not on the top as they appear to be in FIG. 4. The rear cylinder head housing **6** is provided with inlet channels **19** and **20**, and also with an outlet channel **21**, the latter being partitioned from the former by means of a partition wall **22**. The outlet channel **21** is in communication with an outlet port **23** and the rear cylinder bores **101** through outlet valves **103** in valve plate **4**. The first inlet **19** is in communication with an inlet port **24** and said suction channel A, and the second inlet channel **20** is in communication with the rear cylinder bores **101** through inlet valves **102** in the valve plate **4** as well as with the suction channel A. The inlet channels **19** and **20** are partitioned from each other by means of a partition wall **23'**. The dotted line representations of the cylinder bores **101**, the valves **102** and **103**, and the passages **14*a*** and **14*b*** show the relationship of these parts to the channels in the cylinder head when the head is mounted on the compressor in the FIG. 1 position.

The deep depression or chamber **14** in the rear cylinder block **1** is divided into two passages **14*a*** and **14*b*** by means of a partition **25**. Said two passages are so arranged that the passage **14*a*** is in communication with the first inlet channel **19** of the rear cylinder head housing **6** while the passage **14*b*** is in communication with the second inlet channel **20**.

The operation of the invention is as follows: The gaseous refrigerant coming from the evaporator of the air conditioning system is returned to the compressor in the usual cycle of operation. Said returning refrigerant is introduced through the inlet port **24** into the first inlet channel **19**, the incoming flow being represented by a dot, i.e. an arrow coming up out of the plane of the figure. As this inlet channel **19** is not in communication with the rear cylinder bores **101**, all refrigerant is introduced through the first passage **14*a*** into the chamber **14**, as shown by the arrows in FIG. 4. Although the rear valve plate **4** is not illustrated in detail, it is to be understood that said valve plate is provided with passages and appropriate inlet and outlet valves in alignment with both inlet channels **19**, **20** in the rear cylinder head housing **6** and with said passages **14*a*** and **14*b*** of the rear cylinder block **1**, respectively. The refrigerant introduced into the

chamber **14** is divided into two streams, one proceeding through the suction channel A and the chamber **15** into the front cylinder bores as shown by the arrow (FIG. 4), and the remainder being turned back in the chamber **14** and proceeding through the second passage **14***b* into the rear cylinder bores **101**, as shown by the arrows (FIG. 4), through the channel **20** (FIG. 3) and inlet valves **102**. As the pistons **10** move toward the outer end of the bores, the compressed refrigerant is forced out through the outlet valves **103** and along channel **21** to the outlet port **23**. Thus, the velocity of the stream of the refrigerant proceeding toward both rear and front cylinder bores is retarded in the chambers **14** and **15**, whereby relatively heavy oil particles are separated therefrom by the action of gravity. Especially with respect to the refrigerant proceeding toward the cylinder head housing **6** of the rear cylinder block **1**, it will be seen that the refrigerant impinges upon the partition wall **25** at the turning motion of the stream of refrigerant, and the separation of the oil particles will be assisted by the action of inertia. The lubricant oil thus separated will be returned to the oil sump **16** through the partially circumferential channels **17** and **18**. The said partition wall **25** may be dispensed with, so that the returning refrigerant from the first inlet channel **19** is introduced directly into the deep chamber **14** and thence into the rear cylinder bores **101** through the second inlet channel **20**.

From the foregoing, it will be seen that according to the present invention the refrigerant gas delivered from the compressor is cleansed of oil particles as completely as possible, thereby reducing the oil content to the minimum, thereby maintaining good refrigeration efficiency.

What we claim is:

1. A swash plate type compressor for use in an air conditioning system for vehicle and the like, comprising a pair of rear and front cylinder blocks connected in series to form a composite cylinder block, an outer cylindrical casing enclosing said cylinder blocks, a rear cylinder head housing and a front cylinder head housing disposed within opposite ends of said outer casing, valve plates interposed between said cylinder head housings and said cylinder blocks respectively, the composite cylinder block having a longitudinal oil separating channel having at opposite ends deep chambers, and the rear cylinder head housing having two inlet channels, of which the first inlet channel is in communication only with said oil separating channel in the cylinder block through the interposed valve plate and the second inlet channel is in communication with said oil separating channel as well as with the cylinder bores of the rear cylinder block through the interposed valve plate, said first inlet channel and the second inlet channel in the rear cylinder head housing being completely separate from each other.

2. A swash plate type compressor as recited in claim **1**, wherein the deep chamber at the rear end of the composite cylinder block has a partition therein dividing said deep chamber into two passages, a first passage and a second passage, the first inlet channel opening into said first passage and the second passage opening into said second inlet channel and so arranged that the refrigerant gas coming from the first inlet channel in the rear cylinder head housing is fed into said first passage and a part of the refrigerant is turned back through the second passage and introduced into the cylinder bores of the rear cylinder block.

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HENRY F. RADUAZO, *Primary Examiner.*